

**THE GENESIS AND TECTONIC  
SIGNIFICANCE OF CHROMITITE-  
BEARING SERPENTINITES IN SOUTHERN  
NSW**

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**"I declare that the work presented in this thesis is the result of  
original research by the author"**

A handwritten signature in black ink, appearing to read 'Ian T. Graham', written over a horizontal line.

**Ian.T.Graham**

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## ABSTRACT

The Tumut Serpentine Province consists of four major serpentinite belts and numerous small serpentinite bodies, that occupy a long narrow tract within the Lachlan Fold Belt of southern NSW. The tectonic setting of one belt, the Coolac Serpentine Belt, has been contentious. Much of the uncertainty results from lack of a combined study on the major belts and inadequate age constraints. Resolving the uncertainty will benefit construction of a tectonic model for the evolution of the Lachlan Fold Belt.

The belts mainly comprise massive serpentinite or harzburgite, with internal shear zones of schistose serpentinite, and intrusions of plagiogranite, gabbro, basalt, pyroxenite, dunite and chromitite. The main foliation has a consistent NNW-SSE trend and is similar in the adjacent rock units. The various rock types of the serpentinite belts are geochemically akin to similar rocks from ophiolite sequences.

Podiform chromitites are geochemically, mineralogically and geometrically akin to those in the mantle sequence of most ophiolites. The different chromitite types are interpreted in terms of the degree of evolution of the MORB-type magma and hence the extent of fractionation of the source. Serpentinisation and rodingitisation occurred during progressive cooling of the chromitites and host rocks and were accompanied by systematic fracturing and remobilisation of chemical components.

Radioisotope dating gives an age of crystallisation of 412-400 Ma for the plagiogranites and leucogabbros, whilst an inherited zircon age of 430 Ma appears to be derived from Early Silurian felsic volcanic rocks of the region. As the plagiogranites, leucogabbros and other rock types within the serpentinite belts have common deformational and metamorphic histories, their crystallisation age constrains the ages of deformation and metamorphism.

The serpentinite belts are interpreted as ophiolites of the 'embryonic' type that formed within a back-arc basin setting in the Late Silurian-Early Devonian. Crystallisation of the MORB sequence and emplacement onto continental crust, together with metamorphism and deformation may have only spanned 20 Ma. In the Late Silurian to Early Devonian, the Tumut Serpentine Province

differed from basins elsewhere within the Lachlan Fold Belt in that a volcanic arc was ruptured by mantle-derived MORB magmas which ascended to the surface. Their extrusion was short-lived and after the Early Devonian, the development of the Tumut region differed little from that in the rest of the Lachlan Fold Belt.

The development of oceanic crust within the Tumut Serpentinite Province and the generation of granitic magmas within the central and eastern parts of the Lachlan Fold Belt are symptomatic of the same Late Silurian to Early Devonian tectonothermal event. An important aspect of this is that oceanic and crustal rocks need not form from different events or in substantially different tectonic settings.

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